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Intrinsic vs. extrinsic controls on channel evolution in a sub-tropical river, Australia

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Palaeohydrological research provides valuable insights to the understanding of short- and long-term fluvial dynamics in response to climate change and tectonic activity. In landscapes where tectonic activity is minimal fluvial archives record long-term changes in sediment and discharge dynamics related to either intrinsic or extrinsic controls. Isolating the relative controls of these factors is an important frontier in this area of research. Advances in geochronology, the acquisition of high resolution topographic data and geomorphological techniques provide an opportunity to assess the relative importance of intrinsic and extrinsic controls on terrace and floodplain formation. This study presents the results of detailed chrono-stratigraphic research in a partly confined river valley in sub-tropical southeast Queensland. River systems within this region are characterized by high hydrological variability and have a near-ubiquitous compound channel morphology (macrochannel) where Holocene deposits are inset within late Pleistocene terraces. These macrochannels can accommodate floods up to and beyond the predicted 100-year flood. Using single grain optically stimulated luminescence and radiocarbon analyses, combined with high resolution spatial datasets, we demonstrate the nature of fluvial response to major late Quaternary climate change. A large proportion of the valley floor is dominated by terrace alluvium deposited after the Last Glacial Maximum (LGM) (17 – 13 ka) and overlies basal older Pleistocene alluvium. Preliminary results suggest a phase of incision occurred at 10 ka with the formation of the large alluvial trench. The Holocene floodplain is dominated by processes of catastrophic vertical accretion and erosion (cut-and-fill) and oblique accretion at the macrochannel margins. The consistency in ages for the terraces and subsequent incision suggests a uniform network response. Alluvial sediments and channel configuration in this compound and complex landscape represent a discernable response to long-term climate change, high climate variability and extreme weather events.